But it must be remembered that this result is an inferior limit to the value, as it is improbable that either the polar or equatoreal measures were taken. I do not know of any attempt to determine the inclination and node of the equator of *Venus*.

If we neglect the compression and combine the three results of diameter, we shall have

Mean Diameter of *Venus* as a sphere = 63″·948 ± 0″·0603.

These diameters, when reduced to the mean distance, give the following results:—

Declination (Polar?)	semidiameter	= 8″·4308	± 0″·0010.
Right Ascension (Equatoreal?)	,,	= 8″·4633	± 0″·0009.
Or Mean semidiameter as a sphere		= 8″·4518	± 0″·0008.

The following previous determinations may be interesting, for comparison:—

Encke, from Transits of *Venus*	8″·305	Leverrier, *Annales*, vi. p. 26.
Airy, Measures on Meridian	8·283	Do. Do.
Main, D. I. Micrometer	8·775	R. A. S. *Memoirs*, xxv. p 46.
Stone, Measures on Meridian	8·472	R. A. S. *M. N.* xxvi. p. 59.
Plummer, D. I. Micrometer	8·661	Do. xxxiii. p. 561.

The value used in the *American Nautical Almanac* is 8″.546.

Roorkee Observatory,
1875, *March* 2.

Note on the Determination of the Scale in Photographs of the Transit of Venus.

By W. H. M. Christie, Esq.

In a paper in the *Monthly Notices* for March Capt. Abney has given reasons for concluding that photographs of the Sun taken by the English method (in which the primary image is enlarged) must be superior in point of definition both to those taken with lenses of very long focus and to daguerreotypes; but there remains the question—Whether there is any difficulty, peculiar to the first method, in determining the scale to which the distance between the centres of *Venus* and the Sun is referred? This question was naturally considered at an early stage of the British preparations; but I am not aware of any definite statement of the method available: and as the issue has been distinctly raised by Mr. Proctor, in a Note printed in the last number of the *Monthly Notices*, it may, perhaps, be worth while to explain a method which is applicable to all photographs by whatever method obtained, whether of the whole Sun or on a Janssen plate,

and which is equally available for heliometer or double-image measures.

In his Note on this subject Mr. Proctor has pointed out the sufficiently obvious objection that the Sun's diameter is increased by irradiation, whether optical or photographic, which must therefore enter as an unknown correction to the diameter, whether measured in a telescope or on a photograph; but whatever this unknown correction be, it is obvious that it must *diminish* the diameter of *Venus* to nearly, if not exactly, the same amount, so that the sum of the diameters of *Venus* and the Sun will only be affected by the difference of the irradiations. This is probably insensible, since in the English photographs a perfectly "flat" picture of the Sun has been obtained, so that the deposit of silver is of the same density at the limb as near the centre, whilst both *Venus* and the sky round the Sun are photographically black, giving absolutely no deposit. The question can, however, be settled by direct experiment, independently of any theory, for, the optical distortion of the photoheliograph being carefully determined from photographs of such a scale as Mr. De La Rue used at Kew, the breadths of the spider lines at different parts of the field may be calculated; or they may be found by direct measurement on a photograph of the sky, the photographic irradiation being in this case clearly the same all over the field. In any photograph of the Sun, then, it will only be necessary to compare the relative breadths of the spider line at the centre and limb of the Sun with the relative breadths as calculated, in order to obtain the difference of irradiation at the centre and limb.

This correction, then, being applied (if necessary), and also that for optical distortion, the ratio of the corrected distances of the centres of the Sun and *Venus* to the corrected sum of their diameters, as measured on the photographs in millimetres, expresses at once the ratio of the angular distance of the centres to the sum of the true angular diameters, the latter being two out of the five unknown quantities to be determined from all the observations of the Transit.

It is to be remarked that these measures are quite independent of any temperature correction; but in the case of the Janssen plates, only one limb of the Sun being included in the photograph, the scale corresponding to each temperature must be determined from the ordinary plates, and the measures of the diameter of *Venus* on each Janssen plate will then give the irradiation correction for that photograph to be applied to the Sun's limb. The distance of the planet from the limb in such plates being small, there will be no difficulty in determining the temperature correction with abundant accuracy.

It is clear that heliometer measures may be treated by a method generally similar to that applicable to the square plates, and double-image measures of cusps and limbs by that suggested for Janssen plates, the value of the screw being determined inde-

pendently from transits of stars in the case of the double-image micrometer. Thus, in all these cases, irradiation is to be treated as an unknown quantity, affecting all observations, except those of the true black drop, and to be eliminated by suitable treatment of the measures.

The question now arises whether any other method of treatment can be applied with advantage to photographs taken with lenses of long focus; and, in the absence of conclusive experiments bearing on this point, I may content myself with remarking that, the distance of the photographic plate from the optical centre of a forty-feet lens must be determined with a probable error not exceeding 1-9000th part, or 1-18th of an inch, in order to give the scale of the photograph with the same degree of accuracy as measures of diameters which are probably liable to an error of 1-300th of the diameter of *Venus*. Looking to the great difficulty in finding the optical centre of a lens of very long focus, especially when combined with a plane reflector, and the effect of temperature, it seems to me very doubtful whether a focal distance of 40 feet can be determined within 1-18th of an inch, while there is every hope that the probable error of measures of diameter (when made by the same observer throughout) will fall well within the limit assigned. These points, can, however, only be decided by actual experiment; but it is at least open to question whether the inherent difficulties in determining the distances of the primary focus and of the photographic plate from the optical centres of the object-glass, and of the enlarging combination, are really greater in the photoheliographs used by the English, Germans, and Russians, than in the long focus instruments used by the Americans. There is, besides, this important consideration that any error in the determination of the focal length will affect all the photographs taken with the same instrument, with a corresponding systematic error; whilst measures of diameter will only give rise to casual errors.

Blackheath, 1875, *May* 13.

Förteckning öfver Rektascensionerna för 103 *Fundamentalstjernor* (*List of the Right Ascensions of* 103 *Fundamental Stars*).

By Professor Hugo Gyldén: Stockholm.

(*Abstract by Mr. Wackerbarth.*)

Professor Gyldén's object in making the calculations here described was to obtain, for the reduction of his Stockholm Observations a system of fundamental stars, whose right ascensions were determined with all possible accuracy. He refers in the beginning of the essay to two similar works; the one by Professor Newcomb, carried out by that learned and accomplished writer with his usual skill, but with somewhat unsatisfactory